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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/849,221	05/20/2004	Kazuaki Inukai	403085	6822

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LEYDIG VOIT & MAYER, LTD  
700 THIRTEENTH ST. NW  
SUITE 300  
WASHINGTON, DC 20005-3960

EXAMINER

EVERHART, CARIDAD

ART UNIT PAPER NUMBER

2891

DATE MAILED: 12/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/849,221

Applicant(s)

INUKAI ET AL.

Examiner

Caridad M. Everhart

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– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 07 December 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>12-2-05;10-4-05</u> | 6) <input type="checkbox"/> Other: _____  |

### Withdrawal of Finality

Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

### Response to Arguments

Applicant's arguments with respect to claims 1-19 have been considered but are moot in view of the new ground(s) of rejection.

### ***Claim Rejections - 35 USC § 103***

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee, et al (US 6,815,331B2) in view of Robinson et al (US 4,201,579) and further in view of Robb (US 4,529,860).

Lee et al disclose forming an etch stop 704, forming a dielectric 706, and an etch stop 708 and a photoresist 710(Fig. 37) and forming an opening in the photoresist(Fig. 37). The opening formed in the dielectric(Fig. 38) is to be filled with copper(col. 1, line s43-46). The etch stop may be silicon nitride or silicon carbide(col. 9, lines 3-7): The dielectric may be porous silicon oxide(col. 10, lines 55-60) or HSQ(col. 12, lines 63-66). After the etching of the dielectric layer, the photoresist is ashed(col. 16, lines 20-35). The ashing gas is hydrogen and nitrogen(col. 11, lines 65-67 and col. 12, lines 1-5) in a dry etch.

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Lee does not teach hydrogen and inert gas, although Lee does disclose that argon or inert gas may be used in ashing(col. 16, lines 65-68 and col. 17, lines 1-5).

Robinson et al discloses the etching of polymer layers using hydrogen and inert gas such as Ar (col. 1, lines 55-60 and col. 3, lines 28-33).

Robb discloses that nitrogen ashing produces compounds that may react with the photoresist or underlying layers, while the argon will not(col. 6,lines 40-67).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have used the hydrogen and helium in the process taught by Lee because Lee suggests the use of hydrogen and other inert gas than nitrogen and Robb teaches hydrogen and argon for polymer layers, and refers to Robinson with respect to the hydrogen ashing(col. 5, lines 51-55).

Claims are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al in view of Robinson and further in view of Robb and further in view of Savas, et al (US 6,805,139).

Wang, et al disclose the steps of forming an etch stop silicon nitride on a substrate( col. 1, lines 37-41). An interlayer film is formed on the stopper film and a second stopper film is formed which satisfies the limitation of a cap layer which is the second nitride stopper film(col. 1, lines 40-43). Then an opening is formed (col. 1, lines 43-45). It is disclosed that the opening is formed in a photoresist photolithographic process which satisfies the limitation of forming a photoresist with a predetermined pattern, as this is involved in a photoresist photolithographic process(col. 1, lines 40-

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45). An opening is formed in the nitride using the photoresist pattern(col. 1, lines 52-55). The photoresist is stripped(col. 1, lines 52-53). Wang et al further disclose that a barrier is deposited (col. 1, lines 64-67). The deposited metal fill may be copper(col. 4, lines 10-14). The interlayer dielectric layer is a low dielectric constant material which may be HSQ, BCB, Flare, or Silk(col. 9, lines 7-11).

Wang et al is silent with respect to the porosity of the dielectric and with respect to the details of the ashing of the photoresist.

Savas et al discloses that the ashing of photoresist may be carried out using hydrogen and any of the noble gases(col. 18, lines 18-35). The temperature may be 250 degrees C, which is within the recited range(col. 31, lines 55-67).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have used porous dielectric in the method taught by Wang et al because Wang et al teaches low dielectric constant and it is known in the art that the low dielectric constant disclosed by Wang et al may include porosity.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have used the conditions taught by Savas et al in the method taught by Wang et al because the low dielectric constant dielectric would not have been damaged and because Savas et al teach that there would not be residue left (col. 6, lines 10-17).

Claims 4-6, 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al in view of Robinson further in view of Robb as applied to claim 1 above, and further in view of IBM Tech. Discl. Bulletin(Feb. 1967, Vol. 9, Issue 9, page 1228).

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Lee et al in view of Robinson further in view of Robb is silent with respect to the recited percentages of the hydrogen with respect to the inert gas.

IBM Tech. Discl. Bull discloses that hydrogen with argon can be used to remove photoresist with the hydrogen in 5 to 15 % .

It would have been obvious to one of ordinary skill in the art to have used the percentages of the gases taught by IBM Tech. Discl. Bull in the method taught by Wang et al in view of Savas et al in order to completely remove the photoresist as taught by IBM Tech Discl Bull.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Caridad M. Everhart whose telephone number is 571-272-1892. The examiner can normally be reached on Monday through Fridays 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, B. Baumeister can be reached on 571-272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CME  
12-19-05

*C. Everhart*  
CARIDAD EVERHART  
PRIMARY EXAMINER